

SEQUENCE LISTING

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<120> Alpha-Amulase Mutants

<130> 5368.200-US

<140> 09/183,412

<141> 1998-10-30

<150> 60/064,662

<151> 1997-11-06

<150> 60/093,234

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<151> 1997-10-30

<150> PA 1998 00936

<151> 1998-07-14

<160> 58

<170> FastSEQ for Windows Version 3.0

<210> 1

<211> 485

<212> PRT

<213> Bacillus

<400> 1

His	His	Asn	Gly	Thr	Asn	Gly	Thr	Met	Met	Gln	Tyr	Phe	Glu	Trp	Tyr
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Leu	Pro	Asn	Asp	Gly	Asn	His	Trp	Asn	Arg	Leu	Arg	Asp	Asp	Ala	Ala
		20						25					30		
Asn	Leu	Lys	Ser	Lys	Gly	Ile	Thr	Ala	Val	Trp	Ile	Pro	Pro	Ala	Trp
		35					40					45			
Lys	Gly	Thr	Ser	Gln	Asn	Asp	Val	Gly	Tyr	Gly	Ala	Tyr	Asp	Leu	Tyr
	50					55					60				
Asp	Leu	Gly	Glu	Phe	Asn	Gln	Lys	Gly	Thr	Val	Arg	Thr	Lys	Tyr	Gly
65					70				75					80	
Thr	Arg	Asn	Gln	Leu	Gln	Ala	Ala	Val	Thr	Ser	Leu	Lys	Asn	Asn	Gly
			85						90				95		
Ile	Gln	Val	Tyr	Gly	Asp	Val	Val	Met	Asn	His	Lys	Gly	Gly	Ala	Asp
			100					105					110		
Gly	Thr	Glu	Ile	Val	Asn	Ala	Val	Glu	Val	Asn	Arg	Ser	Asn	Arg	Asn
		115					120					125			
Gln	Glu	Thr	Ser	Gly	Glu	Tyr	Ala	Ile	Glu	Ala	Trp	Thr	Lys	Phe	Asp
	130					135					140				
Phe	Pro	Gly	Arg	Gly	Asn	Asn	His	Ser	Ser	Phe	Lys	Trp	Arg	Trp	Tyr
145					150					155				160	
His	Phe	Asp	Gly	Thr	Asp	Trp	Asp	Gln	Ser	Arg	Gln	Leu	Gln	Asn	Lys
				165					170					175	

Ile	Tyr	Lys	Phe	Arg	Gly	Thr	Gly	Lys	Ala	Trp	Asp	Trp	Glu	Val	Asp
			180					185					190		
Thr	Glu	Asn	Gly	Asn	Tyr	Asp	Tyr	Leu	Met	Tyr	Ala	Asp	Val	Asp	Met
		195					200					205			

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Asp His Pro Glu Val Ile His Glu Leu Arg Asn Trp Gly Val Trp Tyr
 210          215          220
Thr Asn Thr Leu Asn Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
225          230          235          240
Ile Lys Tyr Ser Phe Thr Arg Asp Trp Leu Thr His Val Arg Asn Thr
          245          250          255
Thr Gly Lys Pro Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
          260          265          270
Gly Ala Ile Glu Asn Tyr Leu Asn Lys Thr Ser Trp Asn His Ser Val
          275          280          285
Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Asn Ser Gly
          290          295          300
Gly Tyr Tyr Asp Met Arg Asn Ile Leu Asn Gly Ser Val Val Gln Lys
305          310          315          320
His Pro Thr His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro
          325          330          335
Gly Glu Ala Leu Glu Ser Phe Val Gln Gln Trp Phe Lys Pro Leu Ala
          340          345          350
Tyr Ala Leu Val Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr
          355          360          365
Gly Asp Tyr Tyr Gly Ile Pro Thr His Gly Val Pro Ala Met Lys Ser
          370          375          380
Lys Ile Asp Pro Leu Leu Gln Ala Arg Gln Thr Phe Ala Tyr Gly Thr
385          390          395          400
Gln His Asp Tyr Phe Asp His His Asp Ile Ile Gly Trp Thr Arg Glu
          405          410          415
Gly Asn Ser Ser His Pro Asn Ser Gly Leu Ala Thr Ile Met Ser Asp
          420          425          430
Gly Pro Gly Gly Asn Lys Trp Met Tyr Val Gly Lys Asn Lys Ala Gly
          435          440          445
Gln Val Trp Arg Asp Ile Thr Gly Asn Arg Thr Gly Thr Val Thr Ile
          450          455          460
Asn Ala Asp Gly Trp Gly Asn Phe Ser Val Asn Gly Gly Ser Val Ser
465          470          475          480
Val Trp Val Lys Gln
          485

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<210> 2
<211> 485
<212> PRT
<213> Bacillus sp.

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<400> 2
His His Asn Gly Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp His
 1          5          10          15
Leu Pro Asn Asp Gly Asn His Trp Asn Arg Leu Arg Asp Asp Ala Ser
          20          25          30
Asn Leu Arg Asn Arg Gly Ile Thr Ala Ile Trp Ile Pro Ala Trp
          35          40          45
Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr
50          55          60
Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly
65          70          75          80
Thr Arg Ser Gln Leu Glu Ser Ala Ile His Ala Leu Lys Asn Asn Gly
          85          90          95
Val Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
          100          105          110
Ala Thr Glu Asn Val Leu Ala Val Glu Val Asn Pro Asn Asn Arg Asn
          115          120          125
Gln Glu Ile Ser Gly Asp Tyr Thr Ile Glu Ala Trp Thr Lys Phe Asp
          130          135          140
Phe Pro Gly Arg Gly Asn Thr Tyr Ser Asp Phe Lys Trp Arg Trp Tyr

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145          150          155          160
His Phe Asp Gly Val Asp Trp Asp Gln Ser Arg Gln Phe Gln Asn Arg
165
Ile Tyr Lys Phe Arg Gly Asp Gly Lys Ala Trp Asp Trp Glu Val Asp
180          185          190
Ser Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Met
195          200          205
Asp His Pro Glu Val Val Asn Glu Leu Arg Arg Trp Gly Glu Trp Tyr
210          215          220
Thr Asn Thr Leu Asn Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
225          230          235          240
Ile Lys Tyr Ser Phe Thr Arg Asp Trp Leu Thr His Val Arg Asn Ala
245          250          255
Thr Gly Lys Glu Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
260          265          270
Gly Ala Leu Glu Asn Tyr Leu Asn Lys Thr Asn Trp Asn His Ser Val
275          280          285
Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Asn Ser Gly
290          295          300
Gly Asn Tyr Asp Met Ala Lys Leu Leu Asn Gly Thr Val Val Gln Lys
305          310          315          320
His Pro Met His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro
325          330          335
Gly Glu Ser Leu Glu Ser Phe Val Gln Glu Trp Phe Lys Pro Leu Ala
340          345          350
Tyr Ala Leu Ile Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr
355          360          365
Gly Asp Tyr Tyr Gly Ile Pro Thr His Ser Val Pro Ala Met Lys Ala
370          375          380
Lys Ile Asp Pro Ile Leu Glu Ala Arg Gln Asn Phe Ala Tyr Gly Thr
385          390          395          400
Gln His Asp Tyr Phe Asp His His Asn Ile Ile Gly Trp Thr Arg Glu
405          410          415
Gly Asn Thr Thr His Pro Asn Ser Gly Leu Ala Thr Ile Met Ser Asp
420          425          430
Gly Pro Gly Glu Lys Trp Met Tyr Val Gly Gln Asn Lys Ala Gly
435          440          445
Gln Val Trp His Asp Ile Thr Gly Asn Lys Pro Gly Thr Val Thr Ile
450          455          460
Asn Ala Asp Gly Trp Ala Asn Phe Ser Val Asn Gly Gly Ser Val Ser
465          470          475          480
Ile Trp Val Lys Arg
485

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<210> 3
<211> 514
<212> PRT
<213> Bacillus stearothermophilus

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<400> 3
Ala Ala Pro Phe Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr Leu
1          5          10          15
Pro Asp Asp Gly Thr Leu Trp Thr Lys Val Ala Asn Glu Ala Asn Asn
20          25          30
Leu Ser Ser Leu Gly Ile Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys
35          40          45
Gly Thr Ser Arg Ser Asp Val Gly Tyr Gly Val Tyr Asp Leu Tyr Asp
50          55          60
Leu Gly Glu Phe Asn Gln Lys Gly Ala Val Arg Thr Lys Tyr Gly Thr
65          70          75          80
Lys Ala Gln Tyr Leu Gln Ala Ile Gln Ala Ala His Ala Ala Gly Met
85          90          95

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Gln Val Tyr Ala Asp Val Val Phe Asp His Lys Gly Gly Ala Asp Gly
 100 105 110
 Thr Glu Trp Val Asp Ala Val Glu Val Asn Pro Ser Asp Arg Asn Gln
 115 120 125
 Glu Ile Ser Gly Thr Tyr Gln Ile Gln Ala Trp Thr Lys Phe Asp Phe
 130 135 140
 Pro Gly Arg Gly Asn Thr Tyr Ser Ser Phe Lys Trp Arg Trp Tyr His
 145 150 155 160
 Phe Asp Gly Val Asp Trp Asp Glu Ser Arg Lys Leu Ser Arg Ile Tyr
 165 170 175
 Lys Phe Arg Gly Ile Gly Lys Ala Trp Asp Trp Glu Val Asp Thr Glu
 180 185 190
 Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Leu Asp Met Asp His
 195 200 205
 Pro Glu Val Val Thr Glu Leu Lys Ser Trp Gly Lys Trp Tyr Val Asn
 210 215 220
 Thr Thr Asn Ile Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys
 225 230 235 240
 Phe Ser Phe Phe Pro Asp Trp Leu Ser Asp Val Arg Ser Gln Thr Gly
 245 250 255
 Lys Pro Leu Phe Thr Val Gly Glu Tyr Trp Ser Tyr Asp Ile Asn Lys
 260 265 270
 Leu His Asn Tyr Ile Met Lys Thr Asn Gly Thr Met Ser Leu Phe Asp
 275 280 285
 Ala Pro Leu His Asn Lys Phe Tyr Thr Ala Ser Lys Ser Gly Gly Thr
 290 295 300
 Phe Asp Met Arg Thr Leu Met Thr Asn Thr Leu Met Lys Asp Gln Pro
 305 310 315 320
 Thr Leu Ala Val Thr Phe Val Asp Asn His Asp Thr Glu Pro Gly Gln
 325 330 335
 Ala Leu Gln Ser Trp Val Asp Pro Trp Phe Lys Pro Leu Ala Tyr Ala
 340 345 350
 Phe Ile Leu Thr Arg Gln Glu Gly Tyr Pro Cys Val Phe Tyr Gly Asp
 355 360 365
 Tyr Tyr Gly Ile Pro Gln Tyr Asn Ile Pro Ser Leu Lys Ser Lys Ile
 370 375 380
 Asp Pro Leu Leu Ile Ala Arg Arg Asp Tyr Ala Tyr Gly Thr Gln His
 385 390 395 400
 Asp Tyr Leu Asp His Ser Asp Ile Ile Gly Trp Thr Arg Glu Gly Val
 405 410 415
 Thr Glu Lys Pro Gly Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro
 420 425 430
 Gly Gly Ser Lys Trp Met Tyr Val Gly Lys Gln His Ala Gly Lys Val
 435 440 445
 Phe Tyr Asp Leu Thr Gly Asn Arg Ser Asp Thr Val Thr Ile Asn Ser
 450 455 460
 Asp Gly Trp Gly Glu Phe Lys Val Asn Gly Gly Ser Val Ser Val Trp
 465 470 475 480
 Val Pro Arg Lys Thr Thr Val Ser Thr Ile Ala Trp Ser Ile Thr Thr
 485 490 495
 Arg Pro Trp Thr Asp Glu Phe Val Arg Trp Thr Glu Pro Arg Leu Val
 500 505 510
 Ala Trp

<210> 4
 <211> 483
 <212> PRT
 <213> Bacillus licheniformis

<400> 4
 Ala Asn Leu Asn Gly Thr Leu Met Gln Tyr Phe Glu Trp Tyr Met Pro

1	5	10	15
Asn Asp Gly Gln His Trp Arg Arg Leu Gln Asn Asp Ser Ala Tyr Leu			
20	25	30	
Ala Glu His Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Tyr Lys Gly			
35	40	45	
Thr Ser Gln Ala Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr Asp Leu			
50	55	60	
Gly Glu Phe His Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys			
65	70	75	80
Gly Glu Leu Gln Ser Ala Ile Lys Ser Leu His Ser Arg Asp Ile Asn			
85	90	95	
Val Tyr Gly Asp Val Val Ile Asn His Lys Gly Gly Ala Asp Ala Thr			
100	105	110	
Glu Asp Val Thr Ala Val Glu Val Asp Pro Ala Asp Arg Asn Arg Val			
115	120	125	
Ile Ser Gly Glu His Leu Ile Lys Ala Trp Thr His Phe His Phe Pro			
130	135	140	
Gly Arg Gly Ser Thr Tyr Ser Asp Phe Lys Trp His Trp Tyr His Phe			
145	150	155	160
Asp Gly Thr Asp Trp Asp Glu Ser Arg Lys Leu Asn Arg Ile Tyr Lys			
165	170	175	
Phe Gln Gly Lys Ala Trp Asp Trp Glu Val Ser Asn Glu Asn Gly Asn			
180	185	190	
Tyr Asp Tyr Leu Met Tyr Ala Asp Ile Asp Tyr Asp His Pro Asp Val			
195	200	205	
Ala Ala Glu Ile Lys Arg Trp Gly Thr Trp Tyr Ala Asn Glu Leu Gln			
210	215	220	
Leu Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys Phe Ser Phe			
225	230	235	240
Leu Arg Asp Trp Val Asn His Val Arg Glu Lys Thr Gly Lys Glu Met			
245	250	255	
Phe Thr Val Ala Glu Tyr Trp Gln Asn Asp Leu Gly Ala Leu Glu Asn			
260	265	270	
Tyr Leu Asn Lys Thr Asn Phe Asn His Ser Val Phe Asp Val Pro Leu			
275	280	285	
His Tyr Gln Phe His Ala Ala Ser Thr Gln Gly Gly Gly Tyr Asp Met			
290	295	300	
Arg Lys Leu Leu Asn Gly Thr Val Val Ser Lys His Pro Leu Lys Ser			
305	310	315	320
Val Thr Phe Val Asp Asn His Asp Thr Gln Pro Gly Gln Ser Leu Glu			
325	330	335	
Ser Thr Val Gln Thr Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu			
340	345	350	
Thr Arg Glu Ser Gly Tyr Pro Gln Val Phe Tyr Gly Asp Met Tyr Gly			
355	360	365	
Thr Lys Gly Asp Ser Gln Arg Glu Ile Pro Ala Leu Lys His Lys Ile			
370	375	380	
Glu Pro Ile Leu Lys Ala Arg Lys Gln Tyr Ala Tyr Gly Ala Gln His			
385	390	395	400
Asp Tyr Phe Asp His His Asp Ile Val Gly Trp Thr Arg Glu Gly Asp			
405	410	415	
Ser Ser Val Ala Asn Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro			
420	425	430	
Gly Gly Ala Lys Arg Met Tyr Val Gly Arg Gln Asn Ala Gly Glu Thr			
435	440	445	
Trp His Asp Ile Thr Gly Asn Arg Ser Glu Pro Val Val Ile Asn Ser			
450	455	460	
Glu Gly Trp Gly Glu Phe His Val Asn Gly Gly Ser Val Ser Ile Tyr			
465	470	475	480
Val Gln Arg			

<210> 5
 <211> 480
 <212> PRT
 <213> Bacillus amyloliquifaciens

<400> 5
 Val Asn Gly Thr Leu Met Gln Tyr Phe Glu Trp Tyr Thr Pro Asn Asp
 1 5 10 15
 Gly Gln His Trp Lys Arg Leu Gln Asn Asp Ala Glu His Leu Ser Asp
 20 25 30
 Ile Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Tyr Lys Gly Leu Ser
 35 40 45
 Gln Ser Asp Asn Gly Tyr Gly Pro Tyr Asp Leu Tyr Asp Leu Gly Glu
 50 55 60
 Phe Gln Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Ser Glu
 65 70 75 80
 Leu Gln Asp Ala Ile Gly Ser Leu His Ser Arg Asn Val Gln Val Tyr
 85 90 95
 Gly Asp Val Val Leu Asn His Lys Ala Gly Ala Asp Ala Thr Glu Asp
 100 105 110
 Val Thr Ala Val Glu Val Asn Pro Ala Asn Arg Asn Gln Glu Thr Ser
 115 120 125
 Glu Glu Tyr Gln Ile Lys Ala Trp Thr Asp Phe Arg Phe Pro Gly Arg
 130 135 140
 Gly Asn Thr Tyr Ser Asp Phe Lys Trp His Trp Tyr His Phe Asp Gly
 145 150 155 160
 Ala Asp Trp Asp Glu Ser Arg Lys Ile Ser Arg Ile Phe Lys Phe Arg
 165 170 175
 Gly Glu Gly Lys Ala Trp Asp Trp Glu Val Ser Ser Glu Asn Gly Asn
 180 185 190
 Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Tyr Asp His Pro Asp Val
 195 200 205
 Val Ala Glu Thr Lys Lys Trp Gly Ile Trp Tyr Ala Asn Glu Leu Ser
 210 215 220
 Leu Asp Gly Phe Arg Ile Asp Ala Ala Lys His Ile Lys Phe Ser Phe
 225 230 235 240
 Leu Arg Asp Trp Val Gln Ala Val Arg Gln Ala Thr Gly Lys Glu Met
 245 250 255
 Phe Thr Val Ala Glu Tyr Trp Gln Asn Asn Ala Gly Lys Leu Glu Asn
 260 265 270
 Tyr Leu Asn Lys Thr Ser Phe Asn Gln Ser Val Phe Asp Val Pro Leu
 275 280 285
 His Phe Asn Leu Gln Ala Ala Ser Ser Gln Gly Gly Gly Tyr Asp Met
 290 295 300
 Arg Arg Leu Leu Asp Gly Thr Val Val Ser Arg His Pro Glu Lys Ala
 305 310 315 320
 Val Thr Phe Val Glu Asn His Asp Thr Gln Pro Gly Gln Ser Leu Glu
 325 330 335
 Ser Thr Val Gln Thr Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu
 340 345 350
 Thr Arg Glu Ser Gly Tyr Pro Gln Val Phe Tyr Gly Asp Met Tyr Gly
 355 360 365
 Thr Lys Gly Thr Ser Pro Lys Glu Ile Pro Ser Leu Lys Asp Asn Ile
 370 375 380
 Glu Pro Ile Leu Lys Ala Arg Lys Glu Tyr Ala Tyr Gly Pro Gln His
 385 390 395 400
 Asp Tyr Ile Asp His Pro Asp Val Ile Gly Trp Thr Arg Glu Gly Asp
 405 410 415
 Ser Ser Ala Ala Lys Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro
 420 425 430
 Gly Gly Ser Lys Arg Met Tyr Ala Gly Leu Lys Asn Ala Gly Glu Thr
 435 440 445

Trp Tyr Asp Ile Thr Gly Asn Arg Ser Asp Thr Val Lys Ile Gly Ser
 450 455 460
 Asp Gly Trp Gly Glu Phe His Val Asn Asp Gly Ser Val Ser Ile Tyr
 465 470 475 480

<210> 6
 <211> 485
 <212> PRT
 <213> Bacillus sp.

<400> 6
 His His Asn Gly Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr
 1 5 10 15
 Leu Pro Asn Asp Gly Asn His Trp Asn Arg Leu Asn Ser Asp Ala Ser
 20 25 30
 Asn Leu Lys Ser Lys Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Trp
 35 40 45
 Lys Gly Ala Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr
 50 55 60
 Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly
 65 70 75 80
 Thr Arg Ser Gln Leu Gln Ala Ala Val Thr Ser Leu Lys Asn Asn Gly
 85 90 95
 Ile Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
 100 105 110
 Ala Thr Glu Met Val Arg Ala Val Glu Val Asn Pro Asn Asn Arg Asn
 115 120 125
 Gln Glu Val Thr Gly Glu Tyr Thr Ile Glu Ala Trp Thr Arg Phe Asp
 130 135 140
 Phe Pro Gly Arg Gly Asn Thr His Ser Ser Phe Lys Trp Arg Trp Tyr
 145 150 155 160
 His Phe Asp Gly Val Asp Trp Asp Gln Ser Arg Arg Leu Asn Asn Arg
 165 170 175
 Ile Tyr Lys Phe Arg Gly His Gly Lys Ala Trp Asp Trp Glu Val Asp
 180 185 190
 Thr Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Ile Asp Met
 195 200 205
 Asp His Pro Glu Val Val Asn Glu Leu Arg Asn Trp Gly Val Trp Tyr
 210 215 220
 Thr Asn Thr Leu Gly Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
 225 230 235 240
 Ile Lys Tyr Ser Phe Thr Arg Asp Trp Ile Asn His Val Arg Ser Ala
 245 250 255
 Thr Gly Lys Asn Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
 260 265 270
 Gly Ala Ile Glu Asn Tyr Leu Gln Lys Thr Asn Trp Asn His Ser Val
 275 280 285
 Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Lys Ser Gly
 290 295 300
 Gly Asn Tyr Asp Met Arg Asn Ile Phe Asn Gly Thr Val Val Gln Arg
 305 310 315 320
 His Pro Ser His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro
 325 330 335
 Glu Glu Ala Leu Glu Ser Phe Val Glu Glu Trp Phe Lys Pro Leu Ala
 340 345 350
 Tyr Ala Leu Thr Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr
 355 360 365
 Gly Asp Tyr Tyr Gly Ile Pro Thr His Gly Val Pro Ala Met Arg Ser
 370 375 380
 Lys Ile Asp Pro Ile Leu Glu Ala Arg Gln Lys Tyr Ala Tyr Gly Lys
 385 390 395 400
 Gln Asn Asp Tyr Leu Asp His His Asn Ile Ile Gly Trp Thr Arg Glu

405 410 415
 Gly Asn Thr Ala His Pro Asn Ser Gly Leu Ala Thr Ile Met Ser Asp
 420 425 430
 Gly Ala Gly Gly Ser Lys Trp Met Phe Val Gly Arg Asn Lys Ala Gly
 435 440 445
 Gln Val Trp Ser Asp Ile Thr Gly Asn Arg Thr Gly Thr Val Thr Ile
 450 455 460
 Asn Ala Asp Gly Trp Gly Asn Phe Ser Val Asn Gly Gly Ser Val Ser
 465 470 475 480
 Ile Trp Val Asn Lys
 485

<210> 7
 <211> 485
 <212> PRT
 <213> Bacillus sp.

<400> 7
 His His Asn Gly Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr
 1 5 10 15
 Leu Pro Asn Asp Gly Asn His Trp Asn Arg Leu Arg Asp Asp Ala Ala
 20 25 30
 Asn Leu Lys Ser Lys Gly Ile Thr Ala Val Trp Ile Pro Ala Trp
 35 40 45
 Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr
 50 55 60
 Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly
 65 70 75 80
 Thr Arg Asn Gln Leu Gln Ala Ala Val Thr Ser Leu Lys Asn Asn Gly
 85 90 95
 Ile Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
 100 105 110
 Gly Thr Glu Ile Val Asn Ala Val Glu Val Asn Arg Ser Asn Arg Asn
 115 120 125
 Gln Glu Thr Ser Gly Glu Tyr Ala Ile Glu Ala Trp Thr Lys Phe Asp
 130 135 140
 Phe Pro Gly Arg Gly Asn Asn His Ser Ser Phe Lys Trp Arg Trp Tyr
 145 150 155 160
 His Phe Asp Gly Thr Asp Trp Asp Gln Ser Arg Gln Leu Gln Asn Lys
 165 170 175
 Ile Tyr Lys Phe Arg Gly Thr Gly Lys Ala Trp Asp Trp Glu Val Asp
 180 185 190
 Thr Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Met
 195 200 205
 Asp His Pro Glu Val Ile His Glu Leu Arg Asn Trp Gly Val Trp Tyr
 210 215 220
 Thr Asn Thr Leu Asn Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
 225 230 235 240
 Ile Lys Tyr Ser Phe Thr Arg Asp Trp Leu Thr His Val Arg Asn Thr
 245 250 255
 Thr Gly Lys Pro Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
 260 265 270
 Gly Ala Ile Glu Asn Tyr Leu Asn Lys Thr Ser Trp Asn His Ser Val
 275 280 285
 Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Asn Ser Gly
 290 295 300
 Gly Tyr Tyr Asp Met Arg Asn Ile Leu Asn Gly Ser Val Val Gln Lys
 305 310 315 320
 His Pro Thr His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro
 325 330 335
 Gly Glu Ala Leu Glu Ser Phe Val Gln Gln Trp Phe Lys Pro Leu Ala
 340 345 350

Tyr Ala Leu Val Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr
 355 360 365
 Gly Asp Tyr Tyr Gly Ile Pro Thr His Gly Val Pro Ala Met Lys Ser
 370 375 380
 Lys Ile Asp Pro Leu Leu Gln Ala Arg Gln Thr Phe Ala Tyr Gly Thr
 385 390 395 400
 Gln His Asp Tyr Phe Asp His His Asp Ile Ile Gly Trp Thr Arg Glu
 405 410 415
 Gly Asn Ser Ser His Pro Asn Ser Gly Leu Ala Thr Ile Met Ser Asp
 420 425 430
 Gly Pro Gly Gly Asn Lys Trp Met Tyr Val Gly Lys Asn Lys Ala Gly
 435 440 445
 Gln Val Trp Arg Asp Ile Thr Gly Asn Arg Thr Gly Thr Val Thr Ile
 450 455 460
 Asn Ala Asp Gly Trp Gly Asn Phe Ser Val Asn Gly Gly Ser Val Ser
 465 470 475 480
 Val Trp Val Lys Gln
 485

<210> 8
 <211> 485
 <212> PRT
 <213> Bacillus sp.

<400> 8
 His His Asn Gly Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp His
 1 5 10 15
 Leu Pro Asn Asp Gly Asn His Trp Asn Arg Leu Arg Asp Ala Ser
 20 25 30
 Asn Leu Arg Asn Arg Gly Ile Thr Ala Ile Trp Ile Pro Pro Ala Trp
 35 40 45
 Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr
 50 55 60
 Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly
 65 70 75 80
 Thr Arg Ser Gln Leu Glu Ser Ala Ile His Ala Leu Lys Asn Asn Gly
 85 90 95
 Val Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
 100 105 110
 Ala Thr Glu Asn Val Leu Ala Val Glu Val Asn Pro Asn Asn Arg Asn
 115 120 125
 Gln Glu Ile Ser Gly Asp Tyr Thr Ile Glu Ala Trp Thr Lys Phe Asp
 130 135 140
 Phe Pro Gly Arg Gly Asn Thr Tyr Ser Asp Phe Lys Trp Arg Trp Tyr
 145 150 155 160
 His Phe Asp Gly Val Asp Trp Asp Gln Ser Arg Gln Phe Gln Asn Arg
 165 170 175
 Ile Tyr Lys Phe Arg Gly Asp Gly Lys Ala Trp Asp Trp Glu Val Asp
 180 185 190
 Ser Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Met
 195 200 205
 Asp His Pro Glu Val Val Asn Glu Leu Arg Arg Trp Gly Glu Trp Tyr
 210 215 220
 Thr Asn Thr Leu Asn Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
 225 230 235 240
 Ile Lys Tyr Ser Phe Thr Arg Asp Trp Leu Thr His Val Arg Asn Ala
 245 250 255
 Thr Gly Lys Glu Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
 260 265 270
 Gly Ala Leu Glu Asn Tyr Leu Asn Lys Thr Asn Trp Asn His Ser Val
 275 280 285
 Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Asn Ser Gly

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<210> 9
<211> 1455
<212> DNA
<213> Bacillus
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<400> 9						
catcataatg	gaacaaatg	tactatgatg	caatatattcg	aatgggtattt	gccaaatgac	60
gggaatcatt	ggaacagggt	gagggatgac	gcagctaaact	taaagagtaa	agggataaca	120
gctgtaatga	tcccacctgc	atggaagggg	acttcccaga	atgatgtagg	ttatggagcc	180
tctgatttat	atgatcttgg	agagtttaac	cagaagggga	cggtttcgat	aaatatatga	240
acacgcaacc	agctacaggc	tgcggtgacc	tctttaaaaa	ataacggcat	tcaggtatga	300
ggtgatgtcg	tcatgaatca	taaagggtgga	gcagatggta	cggaaattgt	aaatgcggtg	360
gaagtgaatc	ggagcaaccg	aaaccaggaa	acctcaggag	agtatgcaat	agaagcgtgg	420
acaaagtttg	atcttctgtg	aaagaggaaat	aacctatcca	gctttaagtg	gcgctgggat	480
cattttgatg	ggcagcattg	ggatcagtcg	gcgcagcttc	aaacacaaat	atataaatc	540
aggggaacag	gcaaggcctg	ggactgggaa	gtcgatacag	agaatggcaa	ctatgactat	600
cttatgtatg	cagacgtgga	tatggatcac	ccagaagtaa	tacatgaact	tagaaactgg	660
ggagtgtggt	atacgaatac	actgaacctt	gatggattta	gaatagatgc	agtgaacat	720
ataaaatata	gctttacag	agattggcct	acacatgtgc	gtaacaccac	aggtaaacca	780
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<210> 10
<211> 1455
<212> DNA
<213> Bacillus sp.
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<400> 10

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tacgtagggc	aaaataaagc	aggtcaagtt	tggcatgaca	taactggaaa	taaaccagga	1380
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<210> 11

<211> 1548

<212> DNA

<213> *Bacillus stearothermophilus*

<400> 11

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ctttggctgc	cgcccgttta	caaaggaaca	agccgcagcg	acgtagggta	cggagtatac	180
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gatgtcgtgt	tcgaccataa	aggcggcgct	cagggcacgg	aatgggtgga	cggcgtcgaa	360
gtcaatccgt	cgcaccgcaa	ccaagaaaatc	tcgggcacct	atcaaatcca	agcatggacg	420
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acattggccg	tcaccttcgt	tgataatcat	gacaccgaac	ccggccaagc	gctgcagtca	1020
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gattatcttg	atcactccga	catcatcggg	tggacaaggg	aagggggcac	tgaaaaacca	1260
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gttcctagaa	aaacgaccgt	ttctaccatc	gctcggccga	tcacaaccgg	accgtggact	1500
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<210> 12

<211> 1920
 <212> DNA
 <213> Bacillus licheniformis

<220>
 <221> CDS
 <222> (421)...(1872)

<400> 12

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agattattaa	aaagctgaaa	gcaaaaggct	atcaattggt	aactgtatct	cagcttgaag	180
aagtgaagaa	gcagagaggc	tattgaataa	atgagtagaa	gcgccatata	ggcgcttttc	240
ttttggaaga	aaatataggg	aaaatggtac	ttgttaaaaa	ttcggaatat	ttatacaaca	300
tcatatgttt	cacattgaaa	ggggaggaga	atcatgaaac	aacaaaaacg	gctttacgcc	360
cgattgctga	cgctgttatt	tgcgctcatc	ttcttgctgc	ctcattctgc	agcagcggcg	420
gca aat ctt	aat ggg acg	ctg atg	cag tat ttt	gaa tgg tac	atg ccc	468
Ala Asn Leu	Asn Gly Thr	Leu Met	Gln Tyr Phe	Glu Trp Tyr	Met Pro	
1	5		10	15		
aat gac ggc	caa cat tgg	agg cgt ttg	caa aac gac	tcg gca tat	ttg	516
Asn Asp Gly	Gln His Trp	Arg Arg Leu	Gln Asn Asp	Ser Ala Tyr	Leu	
	20		25	30		
gct gaa cac	ggg att act	gcc gtc tgg	att ccc ccg	gca tat aag	gga	564
Ala Glu His	Gly Ile Thr	Ala Val Trp	Ile Pro Pro	Ala Tyr Lys	Gly	
	35		40	45		
acg agc caa	gcg gat gtg	ggc tac ggt	gct tac gac	ctt tat gat	tta	612
Thr Ser Gln	Ala Asp Val	Gly Tyr Gly	Ala Tyr Asp	Leu Tyr Asp	Leu	
	50		55	60		
ggg gag ttt	cat caa aaa	ggg acg gtt	cgg aca aag	tac ggc aca	aaa	660
Gly Glu Phe	His Gln Lys	Gly Thr Val	Arg Thr Lys	Tyr Gly Thr	Lys	
65		70		75	80	
gga gag ctg	caa tct gcg	atc aaa agt	ctt cat tcc	cgc gac att	aac	708
Gly Glu Leu	Gln Ser Ala	Ile Lys Ser	Leu His Ser	Arg Asp Ile	Asn	
	85		90		95	
gtt tac ggg	gat gtg gtc	atc aac cac	aaa ggc ggc	gct gat gcg	acc	756
Val Tyr Gly	Asp Val Val	Ile Asn His	Lys Gly Gly	Ala Asp Ala	Thr	
	100		105		110	
gaa gat gta	acc gcg gtt	gaa gtc gat	ccc gct gac	cgc aac cgc	gta	804
Glu Asp Val	Thr Ala Val	Glu Val Asp	Pro Ala Asp	Arg Asn Arg	Val	
	115		120		125	
att tca gga	gaa cac cta	att aaa gcc	tgg aca cat	ttt cat ttt	ccg	852
Ile Ser Gly	Glu His Leu	Ile Lys Ala	Trp Thr His	Phe His Phe	Pro	
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ggg cgc ggc	agc aca tac	agc gat ttt	aaa tgg cat	tgg tac cat	ttt	900
Gly Arg Gly	Ser Thr Tyr	Ser Asp Phe	Lys Trp His	Trp Tyr His	Phe	
145		150		155	160	
gac gga acc	gat tgg gac	gag tcc cga	aag ctg aac	cgc atc tat	aag	948
Asp Gly Thr	Asp Trp Asp	Glu Ser Arg	Lys Leu Asn	Arg Ile Tyr	Lys	
	165		170		175	
ttt caa gga	aag gct tgg	gat tgg gaa	gtt tcc aat	gaa aac ggc	aac	996
Phe Gln Gly	Lys Ala Trp	Asp Trp Glu	Val Ser Asn	Glu Asn Gly	Asn	

180	185	190	
tat gat tat ttg atg tat gcc gac atc gat tat gac cat cct gat gtc Tyr Asp Tyr Leu Met Tyr Ala Asp Ile Asp Tyr Asp His Pro Asp Val 195 200 205			1044
gca gca gaa att aag aga tgg ggc act tgg tat gcc aat gaa ctg caa Ala Ala Glu Ile Lys Arg Trp Gly Thr Trp Tyr Ala Asn Glu Leu Gln 210 215 220			1092
ttg gac ggt ttc cgt ctt gat gct gtc aaa cac att aaa ttt tct ttt Leu Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys Phe Ser Phe 225 230 235 240			1140
ttg cgg gat tgg gtt aat cat gtc agg gaa aaa acg ggg aag gaa atg Leu Arg Asp Trp Val Asn His Val Arg Glu Lys Thr Gly Lys Glu Met 245 250 255			1188
ttt acg gta gct gaa tat tgg cag aat gac ttg ggc gcg ctg gaa aac Phe Thr Val Ala Glu Tyr Trp Gln Asn Asp Leu Gly Ala Leu Glu Asn 260 265 270			1236
tat ttg aac aaa aca aat ttt aat cat tca gtg ttt gac gtg ccg ctt Tyr Leu Asn Lys Thr Asn Phe Asn His Ser Val Phe Asp Val Pro Leu 275 280 285			1284
cat tat cag ttc cat gct gca tcg aca cag gga ggc ggc tat gat atg His Tyr Gln Phe His Ala Ala Ser Thr Gln Gly Gly Gly Tyr Asp Met 290 295 300			1332
agg aaa ttg ctg aac ggt acg gtc gtt tcc aag cat ccg ttg aaa tcg Arg Lys Leu Leu Asn Gly Thr Val Val Ser Lys His Pro Leu Lys Ser 305 310 315 320			1380
gtt aca ttt gtc gat aac cat gat aca cag ccg ggg caa tcg ctt gag Val Thr Phe Val Asp Asn His Asp Thr Gln Pro Gly Gln Ser Leu Glu 325 330 335			1428
tcg act gtc caa aca tgg ttt aag ccg ctt gct tac gct ttt att ctc Ser Thr Val Gln Thr Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu 340 345 350			1476
aca agg gaa tct gga tac cct cag gtt ttc tac ggg gat atg tac ggg Thr Arg Glu Ser Gly Tyr Pro Gln Val Phe Tyr Gly Asp Met Tyr Gly 355 360 365			1524
acg aaa gga gac tcc cag cgc gaa att cct gcc ttg aaa cac aaa att Thr Lys Gly Asp Ser Gln Arg Glu Ile Pro Ala Leu Lys His Lys Ile 370 375 380			1572
gaa ccg atc tta aaa gcg aga aaa cag tat gcg tac gga gca cag cat Glu Pro Ile Leu Lys Ala Arg Lys Gln Tyr Ala Tyr Gly Ala Gln His 385 390 395 400			1620
gat tat ttc gac cac cat gac att gtc ggc tgg aca agg gaa ggc gac Asp Tyr Phe Asp His His Asp Ile Val Gly Trp Thr Arg Glu Gly Asp 405 410 415			1668
agc tcg gtt gca aat tca ggt ttg gcg gca tta ata aca gac gga ccc Ser Ser Val Ala Asn Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro 420 425 430			1716

ggg gga gca aag cga atg tat gtc ggc cgg caa aac gcc ggt gag aca 1764
 Gly Gly Ala Lys Arg Met Tyr Val Gly Arg Gln Asn Ala Gly Glu Thr
 435 440 445

tgg cat gac att acc gga aac cgt tcg gag cgg gtt gtc atc aat tcg 1812
 Trp His Asp Ile Thr Gly Asn Arg Ser Glu Pro Val Val Ile Asn Ser
 450 455 460

gaa ggc tgg gga gag ttt cac gta aac ggc ggg tcg gtt tca att tat 1860
 Glu Gly Trp Gly Glu Phe His Val Asn Gly Gly Ser Val Ser Ile Tyr
 465 470 475 480

ggt caa aga tag aagagcagag aggacggatt tcctgaagga aatccgtttt 1912
 Val Gln Arg *

tttattttt 1920

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 <211> 1455
 <212> DNA
 <213> Bacillus sp.

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 gctgtatgga tcccacctgc atggaagggg acttcccaga atgatgtagg ttatggagcc 180
 tatgatttat atgatcttgg agagtttaac cagaagggga cggttcgtac aaaatatgga 240
 acacgcaacc agctacaggc tgcggtgacc tctttaaaaa ataacggcat tcaggtatat 300
 ggtgatgtcg tcatgaatca taaaggtgga gcagatggta cggaaattgt aaatgcggta 360
 gaagtgaatc ggagcaaccg aaaccaggaa acctcaggag agtatgcaat agaagcgtgg 420
 acaaagtttg attttctctg aagaggaaat aaccattcca gctttaagtg gcgctgggtat 480
 cattttgatg ggacagattg ggatcagtcg cgccagcttc aaaacaaaat atataaattc 540
 aggggaacag gcaaggcctg ggactgggaa gtcgatacag agaatggcaa ctatgactat 600
 cttatgtatg cagacgtgga tatggatcac ccagaagtaa tacatgaact tagaaactgg 660
 ggagtgtggt atacgaatca actgaacctt gatggattta gaatagatgc agtgaaacat 720
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 catccaaatt caggccttgc caccattatg tcagatggtc caggtggtaa caaatggatg 1320
 tatgtggggg aaaataaaagc gggacaagtt tggagagata ttaccggaaa taggacaggc 1380
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 gtttgggtga agcaa 1455

<210> 14
 <211> 1455
 <212> DNA
 <213> Bacillus sp.

<400> 14
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 gctatttggg ttccgcctgc ctggaaaggg acttcgcaaa atgatgtggg gtatggagcc 180
 tatgatcttt atgatttagg ggaatttaat caaaagggga cggttcgtac taagtatggg 240
 acacgtagtc aattggagtc tgccatccat gcttttaaaga ataatggcgt tcaagtttat 300
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catttcgatg gtgtagattg ggatcaatca cgacaattcc aaaatcgtat ctacaaattc 540
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gaatcatttg tacaagaatg gtttaagcca cttgcttatg cgcttatttt aacaagagaa 1080
caaggctatc cctctgtctt ctatggtgac tactatggaa ttccaacaca tagtgtccca 1140
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atttgggtga aacga 1455

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<210> 15
<211> 60
<212> DNA
<213> Artificial sequence

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<220>
<223> primer

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<400> 15
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```

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<210> 16
<211> 21
<212> DNA
<213> Artificial Sequence

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<220>
<223> Primer

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<400> 16
gaatttgtag atacgatttt g 21

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<210> 17
<211> 24
<212> DNA
<213> Artificial Sequence

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```

<220>
<223> Primer

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<400> 17
cgattgctga cgctgttatt tgcg 24

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```

<210> 18
<211> 24
<212> DNA
<213> Artificial Sequence

```

```

<220>
<223> Primer

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<400> 18

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cttggtccct tgtcagaacc aatg 24

<210> 19
 <211> 30
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Primer

<400> 19
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<210> 20
 <211> 38
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Primer

<400> 20
 cccagtccca cgtacgtccc ctgaatttat atattttg 38

<210> 21
 <211> 38
 <212> DNA
 <213> Artificial Sequence

<220>
 <221> misc_feature
 <222> (0)...(0)
 <223> n on position 12 is 25% A, 25% C, 25% G, 25% T
 Primer

<400> 21
 cccagtccca gntctttccc ctgaatttat atattttg 38

<210> 22
 <211> 25
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Primer

<400> 22
 gcgtggacaa agtttgattt tcctg 25

<210> 23
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 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Primer

<400> 23
 cctaagtatg ggaatcactg g 21

<210> 24
 <211> 24

<212> DNA
 <213> Artificial Sequence

 <220>
 <223> Primer

 <400> 24
 gcattggatg cttttgaaca accg 24
 <210> 25
 <211> 26
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Primer

 <400> 25
 cgcaaaatga tatcgggtat ggagcc 26
 <210> 26
 <211> 29
 <212> DNA
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 <220>
 <223> Primer

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 <220>
 <223> Primer

 <400> 27
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 <210> 28
 <211> 28
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> Primer

 <400> 28
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 <210> 29
 <211> 28
 <212> DNA
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 <220>
 <223> Primer

 <400> 29
 ggtgtatggg atctctcacg acaattcc 28

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    <210> 30
    <211> 32
    <212> DNA
    <213> Artificial Sequence

    <220>
    <223> Primer

    <400> 30
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32

    <210> 31
    <211> 32
    <212> DNA
    <213> Artificial Sequence

    <220>
    <223> Primer

    <400> 31
gggatcaatc acgactcttc caaaatcgta tc
32

    <210> 32
    <211> 34
    <212> DNA
    <213> Artificial Sequence

    <220>
    <223> Primer

    <400> 32
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34

    <210> 33
    <211> 30
    <212> DNA
    <213> Artificial Sequence

    <220>
    <223> Primer

    <400> 33
gctgaatttt ggtcgaatga tttaggtgcc
30

    <210> 34
    <211> 30
    <212> DNA
    <213> Artificial Sequence

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agaggaaaaca tgattcaaaa acgaaagcgg acagtttcgt tcagacttgt gcttatgtgc      300
acgctgttat ttgtcagttt gccgattaca aaaacatcag cc gta aat ggc acg      354
                               Val Asn Gly Thr
                               1

ctg atg cag tat ttt gaa tgg tat acg ccg aac gac ggc cag cat tgg      402
Leu Met Gln Tyr Phe Glu Trp Tyr Thr Pro Asn Asp Gly Gln His Trp
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aaa cga ttg cag aat gat gcg gaa cat tta tcg gat atc gga atc act      450
Lys Arg Leu Gln Asn Asp Ala Glu His Leu Ser Asp Ile Gly Ile Thr
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gcc gtc tgg att cct ccc gca tac aaa gga ttg agc caa tcc gat aac      498
Ala Val Trp Ile Pro Pro Ala Tyr Lys Gly Leu Ser Gln Ser Asp Asn
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gga tac gga cct tat gat ttg tat gat tta gga gaa ttc cag caa aaa      546
Gly Tyr Gly Pro Tyr Asp Leu Tyr Asp Leu Gly Glu Phe Gln Gln Lys
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Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Ser Glu Leu Gln Asp Ala
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atc ggc tca ctg cat tcc cgg aac gtc caa gta tac gga gat gtg gtt      642
Ile Gly Ser Leu His Ser Arg Asn Val Gln Val Tyr Gly Asp Val Val
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Leu Asn His Lys Ala Gly Ala Asp Ala Thr Glu Asp Val Thr Ala Val
                               105                               110                               115

gaa gtc aat ccg gcc aat aga aat cag gaa act tcg gag gaa tat caa      738
Glu Val Asn Pro Ala Asn Arg Asn Gln Glu Thr Ser Glu Glu Tyr Gln
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atc aaa gcg tgg acg gat ttt cgt ttt ccg ggc cgt gga aac acg tac      786
Ile Lys Ala Trp Thr Asp Phe Arg Phe Pro Gly Arg Gly Asn Thr Tyr
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agt gat ttt aaa tgg cat tgg tat cat ttc gac gga gcg gac tgg gat      834
Ser Asp Phe Lys Trp His Trp Tyr His Phe Asp Gly Ala Asp Trp Asp
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gaa tcc cgg aag atc agc cgc atc ttt aag ttt cgt ggg gaa gga aaa      882
Glu Ser Arg Lys Ile Ser Arg Ile Phe Lys Phe Arg Gly Glu Gly Lys
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Lys	Lys	Trp	Gly	Ile	Trp	Tyr	Ala	Asn	Glu	Leu	Ser	Leu	Asp	Gly	Phe	
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Glu	Tyr	Trp	Gln	Asn	Asn	Ala	Gly	Lys	Leu	Glu	Asn	Tyr	Leu	Asn	Lys	
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aca	agc	ttt	aat	caa	tcc	gtg	ttt	gat	gtt	ccg	ctt	cat	ttc	aat	tta	1218
Thr	Ser	Phe	Asn	Gln	Ser	Val	Phe	Asp	Val	Pro	Leu	His	Phe	Asn	Leu	
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Gln	Ala	Ala	Ser	Ser	Gln	Gly	Gly	Gly	Tyr	Asp	Met	Arg	Arg	Leu	Leu	
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Asp	Gly	Thr	Val	Val	Ser	Arg	His	Pro	Glu	Lys	Ala	Val	Thr	Phe	Val	
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Lys	Ala	Arg	Lys	Glu	Tyr	Ala	Tyr	Gly	Pro	Gln	His	Asp	Tyr	Ile	Asp	
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Lys	Ser	Gly	Leu	Ala	Ala	Leu	Ile	Thr	Asp	Gly	Pro	Gly	Gly	Ser	Lys	
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Thr Gly Asn Arg Ser Asp Thr Val Lys Ile Gly Ser Asp Gly Trp Gly	
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Glu Phe His Val Asn Asp Gly Ser Val Ser Ile Tyr Val Gln Lys	
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